

STUDY OF PLEUROAPOPHYSEAL MALFORMATION OF HUMAN ATLAS VERTEBRAE AND ITS CLINICAL SIGNIFICANCE IN WESTERN MAHARASHTRA REGION

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ABSTRACT

Background: Atlas vertebra is one of the important bony components of the Craniovertebral Junction (CVJ). It has articular relationship with Occipital bone and Axis vertebra to complete CVJ. Variations of the Human Atlas vertebra are more frequently found in the Indian subcontinent than anywhere else in the world.

Materials and Methods: Four hundred foramina transversarium of two hundred human Atlas vertebrae of unknown sex and age from the Western region of Maharashtra were grossly studied. The samples taken for study were intact, fully dried, ossified, and that they were free from osteophytes and metastatic tumors. All samples were obtained from Department of Anatomy and Forensic toxicology of Grant Medical College and Sir J.J. group of Hospitals, Mumbai, India. Each Atlas vertebra was observed for the presence or absence of Pleuroapophyseal malformation and also noted whether this malformation was unilateral or bilateral.

Results: In the present study out of 200 dry human atlas vertebrae, 10 cases (5%) of pleuroapophyseal malformations irrespective of age and sex were noted in the Western region of Maharashtra. Out of these 10 cases, 08 cases were observed on left side, 01 case on right side and 01 case of bilateral pleuroapophyseal malformations was present. The statistical analysis was done using the statistical package GraphPad Prism 5 software.

Conclusion: This knowledge of variation in FT of Atlas vertebra is surgically relevant as pleuroapophyseal malformation and narrowing of FT is one of the proposed causative factor for cervicogenic headache.

KEY WORDS: Pleuroapophyseal Malformation, human atlas vertebrae, Forensic toxicology, osteophytes and metastatic tumors.

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Access this Article online

Quick Response code



DOI: 10.16965/ijar.2016.364

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 08 Aug 2016

Peer Review: 09 Aug 2016

Revised: None

Accepted: 29 Sep 2016

Published (O): 31 Oct 2016

Published (P): 31 Oct 2016

INTRODUCTION

Atlas vertebra is one of the important bony components of the Craniovertebral Junction (CVJ). It has articular relationship with Occipital bone and Axis vertebra to complete CVJ. Variations of the Human Atlas vertebra are more

frequently found in the Indian subcontinent than anywhere else in the world. Even in India these Variations are more frequently documented from Uttar Pradesh, Bihar, Rajasthan and parts of Gujarat [1], however such studies about variations in atlas vertebrae are very few in Western

Region of Maharashtra.

The Atlas vertebra has a unique anatomy. The lack of vertebral body and a ring-like shape differs Atlas vertebra from the other cervical vertebrae [2]. It has short anterior and long posterior arches, the lateral masses are bulky, containing superior and inferior articular facets and transverse process bearing Foramina transversarium [3]. FT is formed anteriorly by costal process, posteriorly by true transverse process and laterally completed by bony bar called as "Costotransverse bar". Pleuroapophyseal malformation is the variation of foramen transversarium where one or both sides of FT is deficient because of defect of fusion of different components of transverse process [4]. The consequent loss of bony protection of the vertebral artery in such cases would have compromised with the blood flow particularly during rotatory movements of the neck [5]. So knowledge of this pleuroapophyseal malformation is important for Neurologists, Neurosurgeons, Radiologists, Otolaryngologists and Orthopaedists, who in everyday practice are in contact with disorders of spine and their consequences [6-8].

MATERIALS AND METHODS

Four hundred foramina transversarium of two hundred human Atlas vertebrae of unknown sex and age from the Western region of Maharashtra were grossly studied. The samples taken for study were intact, fully dried, ossified, and that they were free from osteophytes and metastatic tumors. All samples were obtained from Department of Anatomy and Forensic toxicology of Grant Medical College and Sir J.J. group of Hospitals, Mumbai, India. Each Atlas vertebra was observed for the presence or absence of Pleuroapophyseal malformation and also noted whether this malformation was unilateral or bilateral. This study will be helpful in understanding the occurrence of Pleuroapophyseal malformation of Atlas vertebrae in Western Maharashtra region. The developmental variants of the cervical vertebrae, especially C1 and C2, may produce a series of disorders such as headache, vertigo, buzzing in the ears, paresis or paralysis of the extremities. These developmental disorders should always be taken into account

during planning of the diagnostic process in obese and other patients with disturbances within the organ of hearing or the labyrinthine sense [13].

RESULTS

In the present study out of 200 dry human atlas vertebrae, 10 cases (5%) of pleuroapophyseal malformations irrespective of age and sex were noted in the Western region of Maharashtra. Out of these 10 cases, 08 cases were observed on left side, 01 case on right side and 01 case of bilateral pleuroapophyseal malformations was present. The statistical analysis was done using the statistical package GraphPad Prism 5 software.

Table 1: Distribution of Pleuroapophyseal Malformations.

Unilateral		Bilateral	Total no. of Pleuroapophyseal malformations noted out of 200 human atlas vertebrae
Rt.	Lt.		
01 (10%)	08 (80%)	01 (10%)	10

Graph 1: Showing distribution of Pleuroapophyseal malformations, ten cases noted out of 200 human Atlas vertebrae in Western region of Maharashtra.

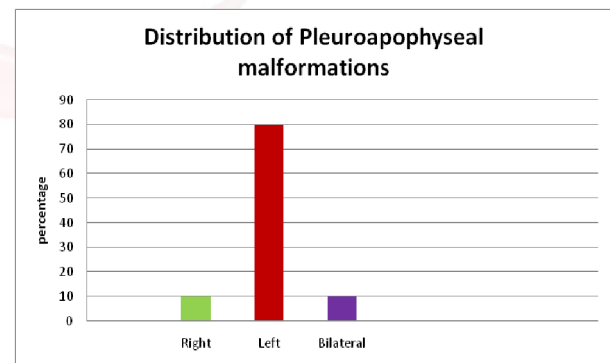


Fig.1: Photograph of superior aspect of atlas vertebra showing pleuroapophyseal malformation (anteriorly deficient foramina transversaria) on right side.

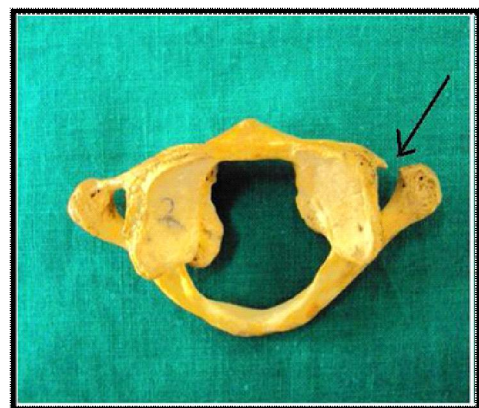


Fig.2: Photograph of inferior aspect of atlas vertebra showing pleuroapophyseal malformation (anteriorly deficient foramina transversaria) on right side.



Fig.6: Photograph of inferior aspect of atlas vertebra showing bilateral pleuroapophyseal malformation (anteriorly deficient foramina transversaria).



Fig. 3: Photograph of superior aspect of atlas vertebra showing pleuroapophyseal malformation (anteriorly deficient foramina transversaria) on left side.



Fig. 4: Photograph of atlas vertebra showing pleuroapophyseal malformation (anteriorly deficient foramina transversaria) on left side.



Fig. 5: Photograph of superior aspect of atlas vertebra showing bilateral pleuroapophyseal malformation (anteriorly deficient foramina transversaria).



DISCUSSION

The second part of the vertebral artery traverses through vicinity of C6-C1 foramen transversarium along with vertebral venous plexus and sympathetic plexus, it then enters the foramen magnum and joins with the corresponding vertebral artery to form basilar artery [2]. Derangement of these structures in their course is due to narrowing, deformities and presence of osteophytes in foramen transversarium which has been investigated by many authors[9].

Dhanraj Singh detected pleuroapophyseal malformations in 12% cases out of 253 atlas vertebrae [5]. Jaroslaw Wysocki et al studied Anatomical variants of the cervical vertebrae and the first thoracic vertebra in man. They found that the greatest variability was demonstrated by the first cervical vertebra that is the Atlas vertebra. They performed study on 100 first cervical vertebrae (37 females and 63 males) that shows an pleuroapophyseal malformation that is anteriorly split foramen of the transverse process in 3 male vertebrae (2.7%) and 5 female vertebrae (6.7%). This phenomenon was invariably an effect of reduction of the anterior lamina of the transverse process and never of the posterior lamina. The occurrence of incomplete FT that is Pleuroapophyseal malformation can be confused with fracture and other anomalies and hence should be known to Radiologists for accurate interpretation of radiographs and hence CT scans [10,11,12]. Due to incomplete formation of FT the vertebral artery may be dislodged and prone to get damaged easily during post cervical injuries.

Qudusia Sultana et al presented a case report on variation of FT in human Atlas vertebrae. In

their case study, out of 100 human Atlas vertebrae they found five cases of pleuroapophyseal malformations, two were unilateral (both from right side) and three were bilateral showing incomplete FT.

CONCLUSION

This knowledge of variation in FT of Atlas vertebra is surgically relevant as pleuroapophyseal malformation and narrowing of FT is one of the proposed causative factor for cervicogenic headache.

However the quantitative anatomical data on Pleuroapophyseal malformation of human atlas vertebra is yet lacking.

As due to the increasing incidence of neck injuries and related syndromes necessitates the study of bony variations of the atlas vertebra and its FT. Due to the incomplete formation of the foramen transversarium, vertebral artery is prone to be damaged easily during posterior cervical injuries and Surgeries. The bony bridges embracing the vertebral artery may be responsible for vertigo and cerebrovascular accidents hence the knowledge of such pleuroapophyseal malformations is important for Physicians, Otorhinolaryngologists, Neurologists, Orthopaedicians and Radiologists.

However, some authors have studied about variations in FT, like its presence or absence. Some authors had studied about the dimensions of the FT by taking vertical and horizontal measurements so that they can decide whether FT is narrow or wide. As FT forms the passageway through which vertebral artery ascends to enter the cranium bilaterally. The compression of vertebral artery as a result of narrowed FT may lead to clinically important consequences for patients at risk. But there is scanty literature available on Pleuroapophyseal malformation and also on the diameter of the FT and its relationship to the uncovertebral joints that necessitates more detail study about this malformation. This study will be helpful clinically, radiologically and surgically as pleuroapophyseal malformation is one of the proposed causative factor for cervicogenic headache.

ABBREVIATIONS

FT - Foramen transversarium

CVJ - craniovertebral junction

RT - right

LT - left,

Conflicts of Interests: None

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How to cite this article:

Shaikh Jasmeen Vajir, Shaikh Shirin Vajir. STUDY OF PLEUROAPOPHYSEAL MALFORMATION OF HUMAN ATLAS VERTEBRAE AND ITS CLINICAL SIGNIFICANCE IN WESTERN MAHARASHTRA REGION. Int J Anat Res 2016;4(4):2902-2906.
DOI: 10.16965/ijar.2016.364